



RADIO TEST REPORT

FCC ID : 2A74O-8A7DD6
Equipment : Wi-Fi Halow Module
Brand Name : Morse Micro
Model Name : MM6108-MF08251
Applicant : Morse Micro Pty Ltd
Level 8, 10-14 Waterloo Street, Surry Hills, NSW 2010
Manufacturer : Morse Micro Pty Ltd
Level 8, 10-14 Waterloo Street, Surry Hills, NSW 2010
Standard : 47 CFR FCC Part 15.247

The product was received on Nov. 14, 2022, and testing was started from Dec. 07, 2022 and completed on Dec. 07, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.


Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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TEL : 886-3-656-9065
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Report Template No.: CB-A10_1 Ver1.3



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Cathy Chiu



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range	Modulation	Ch. Frequency (MHz)	Channel Spacing (MHz)	Channel Number
902-928 MHz	OFDM	903.5-927.5	1	25
		905-927	2	12
		906-926	4	6
		908-924	8	3

Band	Mode	BWch (MHz)	Nant
902-928MHz	OFDM_1M	1	1TX
902-928MHz	OFDM_2M	2	1TX
902-928MHz	OFDM_4M	4	1TX
902-928MHz	OFDM_8M	8	1TX

Note:

- ♦ 902-928 MHz Band uses a combination of OFDM modulation.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	PulseLarsen	W1063	Dipole	Reversed-SMA	1

Note: The above information was declared by manufacturer.



1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
OFDM_1M	0.897	0.47	3.403m	300
OFDM_2M	0.798	0.98	1.563m	1k
OFDM_4M	0.696	1.57	880u	3k
OFDM_8M	0.596	2.25	562.5u	3k

Note:

- ♦ DC is Duty Cycle.
- ♦ DCF is Duty Cycle Factor.

1.1.4 EUT Operational Condition

EUT Power Type	DC power from Adapter		
Beamforming Function	☐ With beamforming	☒ Without beamforming	
Test Software Version	rf_tester.exe (v1.1)		

Note: The above information was declared by manufacturer.

1.1.5 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR262109

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
The transmit path adjustment and addition of some extra bypass caps.	Emissions in Restricted Frequency Bands below 1GHz.

Note: This modification does not affect the RF relevant portion, so it's not necessary to evaluate Intentional test.



1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15.247
- ♦ ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ FCC KDB 558074 D01 v05r02
- ♦ FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location Information				
Test Lab. : Sporton International Inc. Hsinchu Laboratory				
Hsinchu ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)				
(TAF: 3787) TEL: 886-3-656-9065 FAX: 886-3-656-9085				
Test site Designation No. TW3787 with FCC.				
Conformity Assessment Body Identifier (CABID) TW3787 with ISED				

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated Emissions Below 1 GHz	03CH05-CB	Stim Sung	24.2-25.3 / 56-59	Dec. 07, 2022

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Radiated Emission (9kHz ~ 30MHz)	3.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.6 dB	Confidence levels of 95%



2 Test Configuration of EUT

2.1 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode < 1GHz	CTX
The Y axis generated the worst case from the original report, so the measurement will follow this same test configuration.	
1	EUT in Y axis + Adapter

Note: The Adapter is for measurement only, would not be marketed.

Adapter information as below:

Power	Brand	Model
Adapter	STONTRONICS	RPI-18PFCA-05

2.2 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

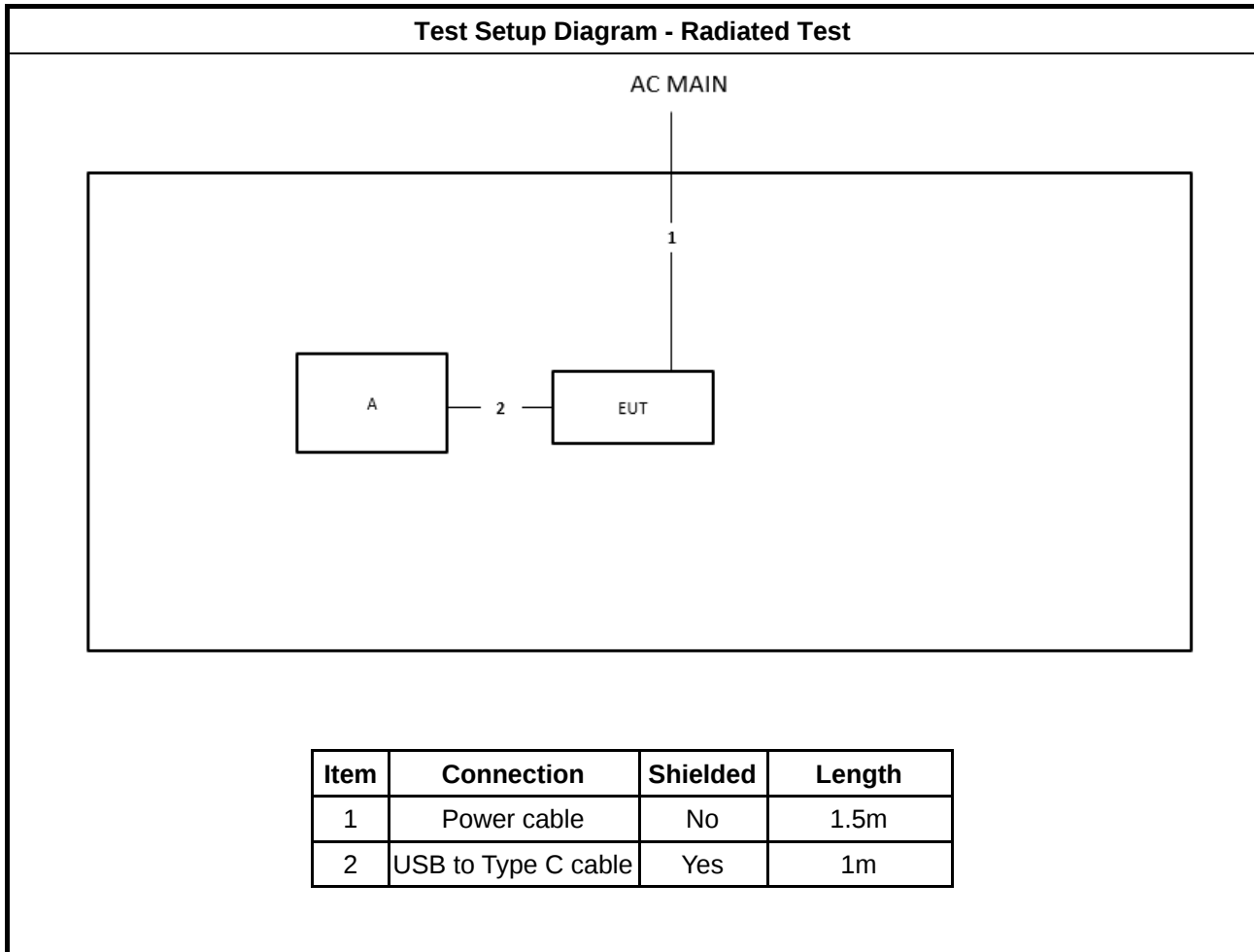
2.3 Accessories

N/A

2.4 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A

2.5 Test Setup Diagram





3 Transmitter Test Result

3.1 Emissions in Restricted Frequency Bands

3.1.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.1.2 Measuring Instruments

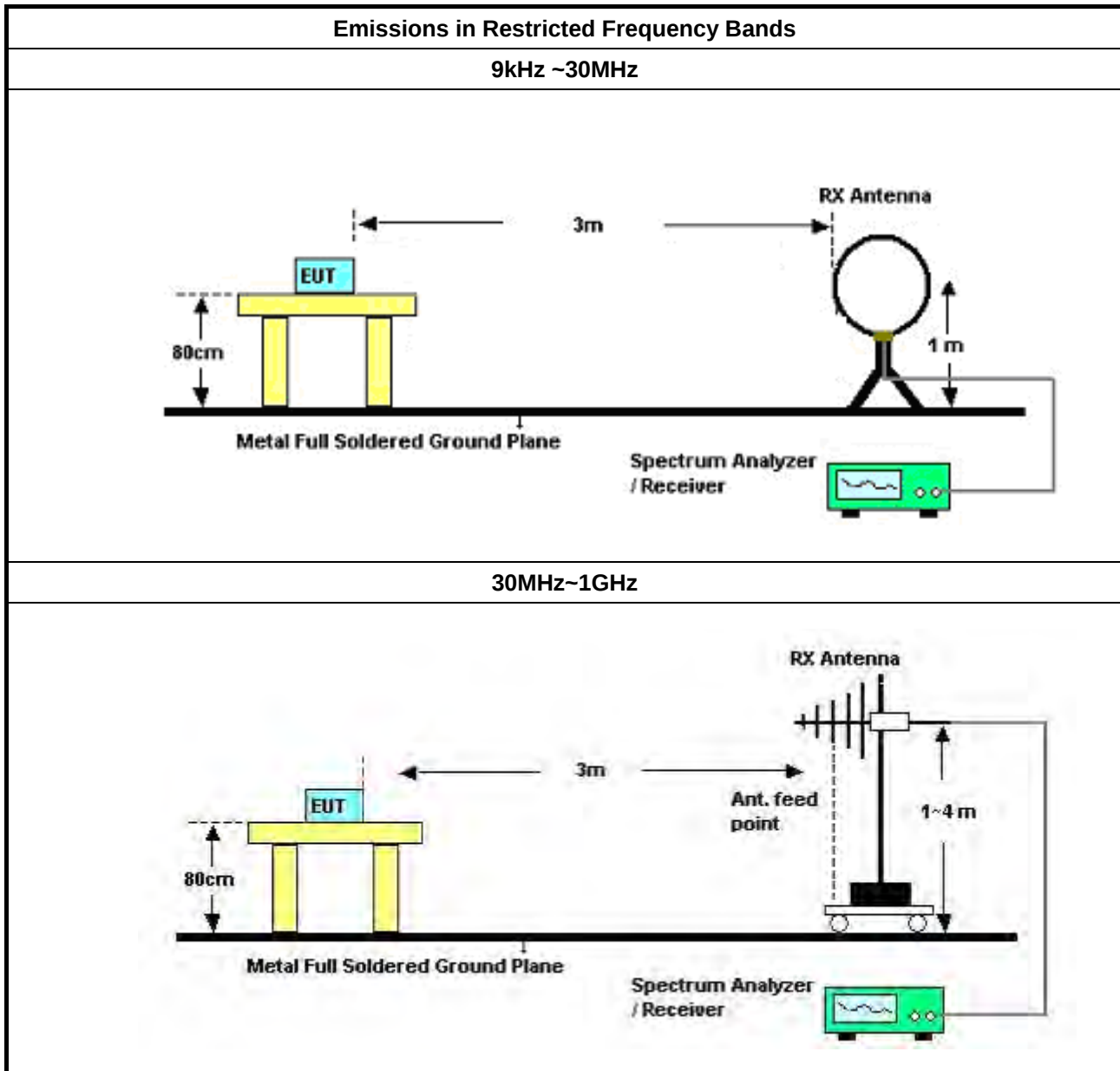
Refer a test equipment and calibration data table in this test report.



3.1.3 Test Procedures

Test Method	
▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
▪ For the transmitter unwanted emissions shall be measured using following options below:	
	▪ Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.
	☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle $\geq 98\%$).
	☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
	☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW $\geq 1/T$).
	☐ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time.
	☐ Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
	☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
▪ For the transmitter band-edge emissions shall be measured using following options below:	
	▪ Refer as FCC KDB 558074 clause 8.7 & c63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	▪ Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.
	▪ Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
	▪ For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB
	▪ For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

3.1.4 Test Setup





3.1.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

3.1.6 Emissions in Restricted Frequency Bands (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10th harmonic or 40 GHz, whichever is appropriate.

3.1.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix A



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	May 14, 2022	May 13, 2023	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 03, 2022	Aug. 02, 2023	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 25, 2022	Mar. 24, 2023	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	Apr. 26, 2022	Apr. 25, 2023	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Mar. 14, 2022	Mar. 13, 2023	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 17, 2022	Jun. 16, 2023	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



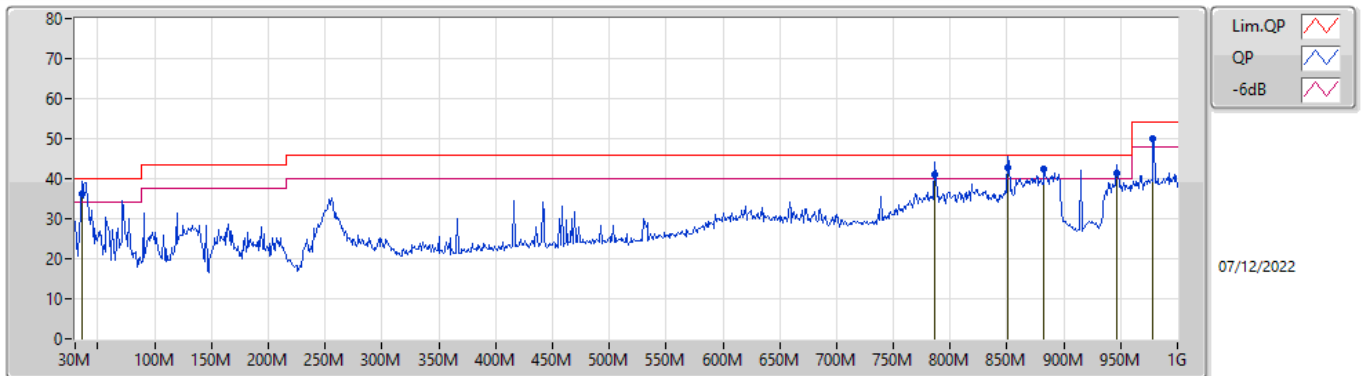
Radiated Emissions below 1GHz

Appendix A

Summary

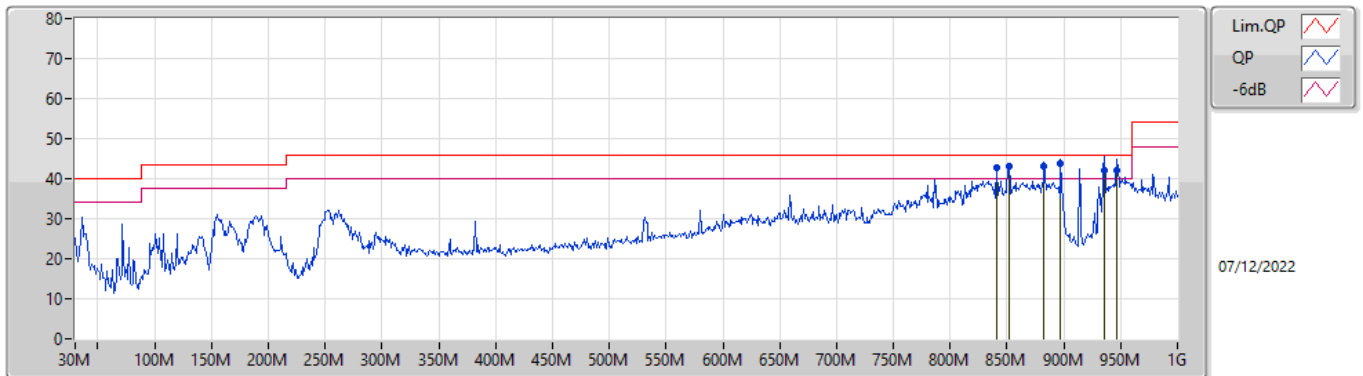
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	QP	897.18M	43.67	46.00	-2.33	Horizontal

Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
QP	35.82M	36.18	40.00	-3.82	-10.26	3	Vertical	140	1.00	-	46.44	20.92	0.52	31.70
QP	786.6M	41.02	46.00	-4.98	-3.14	3	Vertical	205	1.25	-	44.16	25.50	3.90	32.54
QP	850.62M	42.86	46.00	-3.14	-2.58	3	Vertical	0	1.00	"Worst"	45.44	25.88	4.03	32.49
PK	882.63M	42.30	46.00	-3.70	-2.30	3	Vertical	0	1.50	-	44.60	26.08	4.11	32.49
PK	946.65M	41.36	46.00	-4.64	-1.73	3	Vertical	29	2.00	-	43.09	26.44	4.31	32.48
PK	978.66M	49.85	54.00	-4.15	-1.16	3	Vertical	29	2.00	-	51.01	26.88	4.36	32.40

Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	840.92M	42.80	46.00	-3.20	-2.66	3	Horizontal	278	1.50	-	45.46	25.81	4.02	32.49
PK	851.59M	42.98	46.00	-3.02	-2.57	3	Horizontal	60	1.50	-	45.55	25.89	4.03	32.49
QP	882.63M	43.23	46.00	-2.77	-2.30	3	Horizontal	81	1.50	-	45.53	26.08	4.11	32.49
QP	897.18M	43.67	46.00	-2.33	-2.14	3	Horizontal	262	1.50	"Worst"	45.81	26.20	4.15	32.49
QP	935.98M	42.18	46.00	-3.82	-1.87	3	Horizontal	286	2.00	-	44.05	26.33	4.28	32.48
QP	946.65M	41.98	46.00	-4.02	-1.73	3	Horizontal	89	2.00	-	43.71	26.44	4.31	32.48